

REMARKS/ARGUMENTS

Claims 1-3, 5-8 and 10-17 are currently pending. The claims have been amended to show that the cast alloy is a cast steel. Support for this amendment can be found in the published application at paragraphs [0007] and [0019].

Claim Objections

Claims 5 and 6 were objected for informalities. Claims 5 and 6 have been appropriately amended.

Art Rejections

Claims 1, 3, 6-8, and 10-17 were rejected under 35 U.S.C. § 103(a) as unpatentable over JP 2001-234292 to Susumu in view of U.S. Patent No. 4,441,318 to Theckston. Claims 1, 3, 5-8, and 11-17 were rejected under 35 U.S.C. § 103(a) as unpatentable over JP 2002-105599 to Kazuhiro et al. in view of Theckston. Each of these rejections is separately and respectfully traversed. Favorable reconsideration is respectfully requested.

The graphite and nitrogen-free cast steel of the claimed invention has a carbon content of between 0.2 to 0.4 weight percent. Carbon content has a tremendous influence on the mechanical and thermal properties of steel. Applicant respectfully contends that it would not be obvious to one of ordinary skill in the art to compare a cast steel containing between 0.2 and 0.4 weight percent carbon with an alloy where the carbon content is optional and especially where the absence of graphite is not taught or discussed.

Moreover, Susumu discloses an alloy containing less than 0.2% carbon and preferably less than 0.1% carbon. Susumu does not recognize the problems discussed in the pending application regarding the presence of graphite. Therefore, the Applicant respectfully contends that the alloy taught by Susumu is not inherently graphite-free because Susumu does not teach the same composition as far as carbon is concerned. The presence of carbon is not even an essential feature for Susumu and all of the examples given in Table 1 of Susumu have a carbon concentration of less than 0.041%. The specification of the pending application illustrates that the elimination of graphite is an important aspect of the invention. (See paragraphs [0004] to [0006] of the published application.)

The major concern of Susumu is to have an alloy with a very low linear expansion ratio for the purpose of rings to be inserted between gas-turbine elements and ceramic elements. Susumu does not teach a cast steel and should not be considered to disclose a gas-exhaust system. The claimed invention comprises cast steel for structural and/or pressure-containing components for high temperature or low temperature, oxidation and/or corrosion resistant service.

Applicant respectfully contends that the claimed steel is not the same as or made obvious by the alloy of Susumu because Susumu discloses a super alloy with high cobalt concentrations. In Susumu, the presence of cobalt is an essential element and the preferred range is between 22 and 28%. The presence of cobalt makes the alloy a very particular and very expensive alloy that is only suitable for high-tech applications. The super alloy of Susumu is cast under vacuum conditions because the alloy is very sensitive to oxygen (oxidation) due to the presence of cobalt. After being vacuum cast, the Susumu alloy is re-melted through electro-slag refining. In contrast, the steel of the claimed invention is an air-melted cast steel because the claimed steel does not have the oxygen sensitivities of Susumu because the claimed steel is not sensitive to oxygen. In Susumu, silicon is used as an anti-oxidant because the vacuum-melted alloy is extremely sensitive to oxygen due to the presence of cobalt.

While the Examiner contends that the "air-melted" limitation is a product-by-process limitation, Applicant respectfully contends that air-melted limitation of the claimed invention versus vacuum-cast alloy of Susumu should be considered in the context of obviousness to one of skill in the art. It would not be obvious to one of ordinary skill to use Susumu which teaches a vacuum-melted alloy that is extremely sensitive to oxygen because of the presence of cobalt when producing an air-melted cast steel that does not have the same oxygen sensitivities.

The pending application claims a nickel range between 34 and 36%. Susumu claims a nickel range between 30 and 35% and states that with nickel concentrations higher than 35%, the invention does not work. Thus, Susumu teaches away from a nickel concentration greater than 35%. Susumu also discloses a preferred embodiment with 30.5 to 32.05% nickel, which is out of the range claimed in the pending application.

Moreover, the combined presence of nickel and cobalt in the percentages disclosed by Susumu result in an alloy that cannot be considered a steel because less than 50% of iron is

present. The claims of the pending application have been amended to show that the claimed invention is a cast steel.

In Susumu, the presence of aluminum is an essential element. (See ¶ [0024].) The preferred concentration of aluminum is between 1 and 2% and, without the presence of aluminum, the invention does not work. In the pending application, a maximum of 1% of aluminum is used when proceeding with precipitation hardening. The presence of aluminum is not necessary when the cast steel is not strengthened by precipitation hardening and, therefore, is not claimed in claim 1. Aluminum is only necessary for specific embodiments of the invention and, therefore, is only claimed in dependent claims directed to those specific embodiments.

Because Susumu teaches an alloy, not a cast steel, with high cobalt concentrations that is used for a different purpose, has different ranges of carbon, aluminum, and nickel and is extremely sensitive to oxygen, and does not teach that the alloy is graphite-free, it would not be obvious for one of ordinary skill in the art to combine the alloy of Susumu with the turbine exhaust system of Theckston.

The claimed invention is also not made obvious by Kazuhiro in view of Theckston. Kazuhiro discloses an alloy where the carbon concentration is not an essential element. Kazuhiro also does not recognize the problems associated with the presence of graphite nor does Kazuhiro teach that graphite is not present. Moreover, none of the examples given under ¶ [0054] have more than 0.178% of carbon, which is below the minimum value claimed in the pending application.

The purpose of Kazuhiro is to create an anti-corrosion alloy with very low linear expansion coefficient at very low temperature. The different tests performed on this alloy described in ¶ 0048 have been performed at temperatures between -196° C (liquid nitrogen) and +54° C. The purpose of Kazuhiro is to create an alloy for highly pressure-resistant LPG tanks that are able to store liquids at very low temperature.


In contrast, the purpose of the pending application is instead to create an exhaust system resisting very high temperatures. Therefore, one of ordinary skill in the art would not be motivated to combine an alloy from Kazuhiro having a very low linear expansion coefficient at very low temperatures with the turbine exhaust system of Theckston.

Further, Kazuhiro teaches that the silicon content should not exceed 0.6%. In the preferred embodiment, Kazuhiro teaches that the silicon content is about 0.3% because otherwise the alloy has cracking problems. (See ¶ [0032].) In contrast, in the pending application the silicon content is between 0.5 and 6%. Additionally, none of the examples disclosed in Table 1 of Kazuhiro (see ¶ [0054]) have a silicon content higher than 0.34%, which is again out of the range claimed and disclosed in the examples of the pending application.

The claimed invention is novel and non-obvious. Favorable reconsideration is requested. For the reasons set forth above, reconsideration of the rejections is respectfully requested.

In view of the amendments and remarks recited herein, the application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,
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